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(54) **IMPROVEMENTS RELATING TO VEHICLE STEERING MECHANISMS.**

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Description

This invention relates to steering mechanisms for steering the rear end of a long vehicle. The invention is more specifically concerned with such vehicles as articulated lorries comprising a cab portion incorporating the engine and a long trailer linked to the cab portion by a pivot device, or even non-articulated cab and trailer combinations. Other possible uses for the steering mechanism are in trailer caravans, tracked vehicles or even such vehicles as boats or ships.

At present an articulated lorry may have wheels on fixed axles situated at the rear of the trailer. When the vehicle negotiates a bend, the rear wheels initially tend to follow the original direction of motion until the rear end begins to slew round into the new direction in which the cab is heading. As a result a long vehicle requires a fairly large turning circle and on tight bends will tend to stray substantially onto the other side of the road. Also undue stresses are applied to the tyres which are rubbed laterally across the road surface and distorted during the turning action so that they are subjected to significant wear. Furthermore, on slippery surfaces, because the rear wheels are tending to slide over the surface, the possibility of jack-knifing occurring is greatly increased.

It is also known to provide a direct steering linkage between the cab and steered rear wheels of the trailer with the result that, as the cab turns relative to the trailer, the rear wheels turn to the same degree at the same time. Consequently the rear end of the trailer tends to be driven immediately towards the outside of the bend thus possibly encroaching over the centre line of the road or onto the pavement. Again therefore the driver requires a larger turning circle on the bend.

U.S. Patent Specification 3533645 corresponding to the preamble of claim 1 discloses a steering mechanism for a long vehicle wherein a cam face on the cab of the vehicle acts on rods running the length of the trailer of the vehicle so as to cause a bogie at the rear of the trailer to be moved out of alignment by the other ends of the rods so as to cause the rear end of the trailer to follow a path close to that taken by the cab of the vehicle. The wheels on the bogie are on fixed axles. French Patent Specification 2260485 discloses a bogie for the trailing end of a long vehicle, which bogie has steerable front wheels.

It is an object of this invention to provide a steering mechanism for a long vehicle which will enable the vehicle more closely to follow curves into the route which the vehicle is taking and will operate automatically to this effect.

The invention relates to a type of steering mechanism for a long vehicle which has leading and trailing ends and which comprises:—

a first steering device located towards the leading end;

a second steering device located towards the trailing end;

a linkage between the first and second steering devices;

actuating means within that linkage, and responsive both to a first angle which the first steering device makes with the fore-and-aft centreline of the vehicle and a second angle which the second steering device makes with the same line;

said actuating means being designed to operate on the second steering device to cause the trailing end of the vehicle to follow an existing direction of motion whenever the second angle is less than a predetermined function of the first angle, but operating under other conditions on the second steering device to cause the trailing end of the vehicle to progress to a condition wherein equality between the second angle and that function of the first angle is achieved. The invention is characterised by the features that a steering member is located towards the trailing end and is controlled by the second steering device so that the steering member will act in a steering mode in which it positively steers that end of the vehicle or in a following mode in which it follows an existing direction of motion which is in a straight line or follows an arc of constant radius; and

the second steering device includes a follower member which is freely rotatable about a vertical axis of the vehicle so as to be free to follow an existing direction of motion and forming part of means to steer the steering member, and the actuating means comprises a guide member which is interlocked with the follower member in the following mode for rotational movement therewith and released from the follower member in the steering mode so as to rotate relative to the follower member and cause adjustment of the steering member, such that the second steering device locks the steering member in its following mode whenever the second angle is less than the predetermined function of the first angle, but operates under other conditions to make the steering member operate in its steering mode in a manner which tends to make the second steering device progress to the condition wherein equality between the second angle and that function of the first angle is achieved.

As a result of the operational relationship between the guide member and the follower member steering of the rear end of the vehicle is delayed until some time after the front of the vehicle has taken a new direction with the result that the rear end of the vehicle more nearly follows the path of the front end of the vehicle.

In general it is envisaged that the steering mechanism will incorporate two linkages which are displaced independently as the leading end of the vehicle moves to the right or left respectively, these two linkages preferably operating upon respective locking mechanisms which control the interconnection of the guide member with the follower member and the extent of allowable movement of the guide member. Thus the locking mechanism may comprise a first part which, upon

displacement of one of the linkages, locks the guide member against rotation in one direction relative to the follower member, and a second part which, when the guide member has been rotated with the follower member to a condition when the actuating means is in the steering mode, will release the lock between the guide member and the follower member and also prevent further rotation of the guide member in the one direction.

The linkages can be designed to control the state of the locking mechanism, which may take many forms and could therefore be in the form of a clutch, a calliper brake or stepless ratchet. In one arrangement, however, the locking mechanism will incorporate a disc carried by the follower member and gripping members which are biased into locking contact with the disc to prevent rotation of a portion of the guide member in one direction or the other about the axis of the disc. The two linkages will then each incorporate a release member which will act upon the gripping members to release the gripping members from the disc, to enable relative rotation between the guide member and the follower member to take place and thus cause operation of the steering member. These gripping members could comprise arms biased into contact with the surface of the disc or balls biased into contact with the disc by inclined planes.

The linkages may be operated in several ways upon rotation of a member associated with a rotatable part of the first steering device. For example this rotatable part may carry cams which operate on slidably mounted blocks to which the linkages are pivotally connected so that these linkages are displaced as the blocks slide in their tracks.

Alternatively the rotatable part of the steering mechanism could carry arms to which the steering linkages are pivotally connected, these arms being driven round with the rotatable part. It is desirable, however, to provide means for limiting the extent of movement of the linkages, such as by providing a spring connection between the rotatable part of the arms carrying the linkages, and a limit stop.

The first steering device may comprise a steering wheel or tiller, one or more steering axles, a turntable bogie with non-steered axles turned by a drawbar, a turntable bogie which steers itself using one or more steering axles, a pivoted axle or an axle turned by a drawbar, the pivotal interconnection of a driving cab with a trailer, differential drive of left and right non-steered wheels or tracks or in the case of a ship of boat, a rudder or some other rotatable part, which initiates steering of the leading end of the vehicle.

The follower member at the trailing end of the vehicle may comprise a turntable bogie mounted on wheels providing the steering member, a pair of wheels carried by a pivoted axle or a castor-type wheel in the case of a wheeled vehicle. If the vehicle is a ship or boat then the follower member would be in the form of a rudder or vane. The steering member may be carried by the follower member and comprise wheels carried by steered axles or pivoted axles or a power steering member which acts to steer the follower member relative to the vehicle body. Alternatively the turntable bogie or a castor-type wheel may be separate from the steering member in the form of wheels carried by one or more steered or pivoted axles. A further possibility is to provide that the steering member acts on a differential drive using fixed wheels or left and right tracks. In the case of a boat, the steering member would be a further rudder which is large enough to be able to create steerage of the rear of the vehicle. In these instances, the wheels or rudder carried by or comprising the follower member will constitute the steering member which initially tends to follow the original direction of travel of the vehicle.

A desirable feature of the apparatus is the provision of the guide member which will initially move with the follower member but which will subsequently be caused to move relative to the follower member so that the steering member operates to steer the rear of the vehicle.

In most cases it is envisaged that the function of the first angle with the second angle will be a direct one to one function, although there may be occasions where, due for example to limitations of space, a different ratio will be desirable. When the vehicle is negotiating an S-bend, it will be appreciated that if the trailing end has started to be steered to follow the leading end, but the leading end then enters a turn in the opposite direction, the effect will be to put the steering member into the following mode. However since the steering member will already be in a steered state it will move along an arc of constant radius whilst it remains in that following mode.

The invention may be performed in various ways and preferred embodiments thereof will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a side view of an articulated lorry incorporating a steering mechanism of this invention;

Figure 2 illustrates an alternative form of steering mechanism for the trailer of the vehicle;

Figure 3 is a plan view of a steering linkage of the mechanism;

Figure 4 is a detail illustrating the interconnection of a guide member and a disc forming part of the mechanism as viewed in the direction IV in Figure 3;

Figure 5 is a plan view of the guide member similar to that of Figure 3 but in an alternative attitude;

Figures 6 and 7 illustrate an alternative form of steering linkage arrangement in plan view;

Figure 8 is a vertical section through parts of the mechanism interconnecting the guide member and a bogie member;

Figure 9 is a plan view of the bogie member;

Figures 10 to 13 illustrate diagrammatically the

sequence of movements of the articulated vehicle when steering is applied to it;

Figure 14 is an underneath plan view of another form of steering mechanism of the invention; and

Figures 15 and 16 illustrate two further alternative forms of steering linkage arrangements.

In Figure 1 there is shown an articulated lorry comprising a driven cab portion 1 and a trailer body 2 pivotally interconnected at 3 in a conventional way. A steering linkage 4 leads back from the pivot 3 to a guide member arrangement 5 associated with a pivotally mounted bogie 6 carrying a pair of wheels 7 on a fixed rear axle and a steerable pair of wheels 8 on the forward part of the bogie 6. In the modified arrangement shown in Figure 2 a castor-type wheel 9 is provided instead of the bogie 6 and rear wheels 7 but this castor-wheel 9 is linked with a modified form of guide member arrangement 5 which is associated with the steerable forward wheels 8.

As shown in Figure 3, the pivot member 3, which rotates with the cab 1 as the cab is steered into a new direction, has a cam 10 fixed thereto so as to rotate with the pivot member 3. The pivot member 3 also carries a further cam of identical shape but oppositely handed (not shown). The cam 10 acts on a pair of bushes 11 carried by a slidable block 12 guided by rollers 13. A slot 14 in the block allows the block to slide relative to the pivot member 3. The end of the block 12 is connected to a linkage 15 through a pivot 16, the other end of the linkage being connected by a pivot 17 to an arm 18 which itself pivots about a main shaft 19. The arm 18 has an upstanding limb 20 carrying a screw 21. When the limb 20 is situated adjacent the side of a guide member body 22, the screw 21 will contact a pivotally mounted gripping pin 23 biased towards the screw 21 by a spring 24. If the arm 18 is rotated about the shaft 19, the pin 23 is freed by the retraction of the screw 21 but in doing so bears against the surface of a disc 25 which effectively locks the body 22 against further rotation relative to the disc 25. This is illustrated in particular in Figures 3 and 4 of the drawings.

An extension portion 26 secured to the shaft 19 is adjustable interconnected with the body 22 by screws 27. Thus when the body 22 is locked to the disc 25 by a gripping pin 23 against rotation in one direction, this effectively interconnects the disc 25 with the shaft 19 during rotation in that particular direction.

A similar construction of the block 12, steering linkage 15, arm 18 with the upstanding limb 20 carrying a screw 21 is interconnected with the oppositely handed cam 10 and acts on the opposite side of the body 22 to control another gripping pin 28. For clarity these additional parts have been omitted from Figure 3 but the two steering linkages 15 can be seen in Figure 4.

Figures 6 and 7 illustrate a modified arrangement attached to the respective ends of one of the steering linkages 15. Thus, at the forward end of the vehicle, the linkage 15 is connected by the pivot 16 to an arm 29 which rotates freely about the main pivot 3. Another, essentially L-shaped arm 30, has an extension portion 31 which abuts the arm 29 and is also freely mounted about the pivot 3. A pin 32 fixed to the cab acts on the arm 30 to rotate that arm about the pivot 3 when the cab rotates in one direction relative to the vehicle body. A spring 33 causes the arm 29 to be carried round with the arm 30 until the arm 29 meets a stop 34 which inhibits further movement of the steering linkage 15 even if the arm 30 should continue to rotate. (Again the other arm 30, to the other side of the pin 32, and associated parts have been omitted for clarity). A further stop 35 limits the extent of movement of the steering linkage 15 in the other direction, thus ensuring that the pin 32 causes movement of only one of the steering linkages 15.

From Figure 7 it will be seen that the other end of the steering linkage 15 is connected by the pivot pin 17 to a modified form of arm 18A which is rotatably mounted about the main shaft 19, and which has an upstanding portion 20A carrying a screw 21. In this case, the body 22 does not carry a gripping arm (23) but instead defines inclined planes 36 which, in combination with a face of the disc 25, serve to trap steel balls 37 which are biased away from one another by a spring 38. When the arm 18A moves away from a limit stop 39 to retract one of the screws 21, the associated ball 37 will jam in the narrow space between the inclined plane 36 and the disc 25 and thus effectively lock the body 22 onto the disc 25 against rotation in that direction. Again an extension portion 26 interconnects a body 22 with the main shaft 19. A return spring 39A acts to draw the arm 18A back to the position shown in Figure 7.

Referring now to Figure 8, the main shaft 19 defines an axis of rotation of a frame of the bogie 6 (as also shown in Figure 9). This bodie frame carries the rear wheels 7 on a fixed axle 40 and the steerable wheels 8. A ring 41 is rotatable relative to four retainer members 42 on the frame of the bogie 6 and this ring 41 carries brackets 43 connected by pivot pins 44 to the main chassis 45 of the trailer body. The bogie frame itself is linked by pivot pins 46 to a collar member 47 which is rotatably mounted around the shaft 19 and passes up through the chassis 45 and one of the arms 18 to a point where it is rigidly attached to the disc 25. The disc 25 is situated within the body 22 to which it may be linked by a gripping pin 23, for example, and as previously explained the body 22 is secured to the extension portion 26 which is integral with the shaft 19.

The shaft 19 is connected, via a pivot pin 48, to a lower extension 19A which is journalled in part of the frame of the bogie 6. This shaft extension 19A has a plate 49 attached thereto which in turn is pivotally linked to an arm 50 by a pivot pin 51. This arm 50 (Figure 9) is in turn connected by a pivot pin 52 to a L-shaped arm 53 which is pivotally mounted at 53A to the frame of the bogie 6. The end of the arm 53 carries a fork which receives a stud 54 on a steering link 55 whose

ends control the attitude of the two steerable wheels 8. Thus it will be seen that rotation of the shaft 19 relative to the frame of the bogie 6 will cause the wheels 8 to be steered out of alignment with the rear wheels 7 carried by the bogie. A servo drive 56 may be provided on the arm 50 to cause controlled extension of that arm independent of that due to rotation of the shaft 19 with respect to the bogie 6. This servo would be controlled from the cab of the vehicle and can be actuated as an over-ride during forward drive, and would also be of particular advantage, for example, when reversing the vehicle. Although the servo mechanism 56 has been shown positioned between the plate 49 and the arm 53 it will be appreciated that the linking arm 50 could be extended to the other side of the plate 49 and have a return portion leading back to the pivot pin 51, with the servo mechanism acting on the parts of the arm 50 lying beyond the plate 49.

The operation of the mechanism shown in Figures 1 to 9 of the drawings will now be explained with reference to Figures 10 to 13 of the drawings. These latter Figures comprise just a diagrammatic representation of the cab 1, the trailer body 2, the bogie 6 carrying the rear wheels 7 and steerable front wheels 8, the guide member body 22 and the two limbs 20R and 20L associated with the arms 18 controlled by the steering linkages 15.

In the position shown in Figure 10, the vehicle is moving straight ahead, so the bogie 6 and the wheels 7 and 8 are aligned with the vehicle body 2. However when the cab 1 is turned to the left so that the vehicle body 2 tends to follow this new direction of movement (as shown in Figure 11) the bogie 6 will continue to point in the original direction (as shown) with the front wheels 8 aligned with the bogie. However one of the steering linkages 15 will operate to move the limb 20L away from the guide member 22 so that the guide member 22 is effectively locked with the bogie 6 (through the mechanism illustrated in Figure 8). After a time, however, the angle between the longitudinal axis of the trailer 2 and the longitudinal axis of the bogie 6 will become equal to or greater than the angle between the longitudinal axes of the vehicle body 2 and the cab 1. This will come about either because the bogie 6 has continued to travel along its original path whilst the cab 1 and body 2 keep on turning round the bend, or additionally because the cab 1 has begun to straighten with respect to the body 2 as the cab portion 1 starts to come out of the bend. As a result the attitude of the bogie 6 relative to the trailer 2 will be such that the limb 20L will now come into contact again with the guide member 22, thus releasing the guide member 22 from the bogie 6 (at least in one direction of rotation) so that the guide member 22 now begins to rotate anti-clockwise with respect to the bogie 6. The guide member 22 will in fact be pushed round by the limb 20L with which it is now in contact. This causes the front wheels 8 to be steered into the direction of the curve taken by the vehicle, as shown in Figure 12. Eventually as the cab 1 continues again along a straight line path, the guide member 22 will be aligned with the trailer 2 and any misalignment of the bogie 6 will eventually be eliminated since the bogie will be steered back into the aligned position by the wheels 8. This latter stage of the operation is illustrated in Figure 13.

It will be appreciated that the pivot pins 44, 46 and 48 allow the bogie to pivot with respect to the chassis 45 of the trailer if the vehicle travels over an undulating surface and the pivots at these points will be so designed as to be effective even if the bogie 6 is rotated with respect to the trailer body or if the shaft 19 has rotated with respect to the bogie frame.

Whilst Figure 2 shows a construction having a single castor wheel 9, as shown in Figure 14, a pair of castor wheels 57 carried by a fixed axle 58 could be provided. These castor wheels will be connected by Ackerman steering arms 59 to a linkage 60 controlling a track rod 61 interconnected with the disc 25. The caster wheels 57 tend to follow the original line of movement of the vehicle even when the trailer body 2 turns about the axis of the disc 25 and the relative rotation of the castor wheel shafts with respect to the body 2 causes rotation of the disc 25 and the associated guide member body 22 until such time as the limbs 20 come into play to stop further rotation of the guide member body 22 resulting in steering being applied to the wheels 8 through a servo mechanism 62, if provided. The single castor-type wheel 9 version described in connection with Figure 2 is ideally suited to towed trailers and caravans towed by motor cars.

The modified linkage arrangements illustrated in Figures 15 and 16 both incorporate actuator rams 63, whose directions of operation on arms 18A are controlled by respective sliding valves 64. The rams 63 are connected to a suitable high pressure oil supply incorporating an electric pump or other pressure inducing mechanism in the cab of the vehicle. Each valve 64 of Figure 15 is directly actuated by movement of the mechanical steering linkage 15 pivoted to an arm 29. Movement of the valve to the left in the drawing results in the actuator operating to pull the arm 18A to the left until the valve 64 is centralised, and *vice versa*. The connection to the arm 18A is adjustable by rotating a nut 65 so as to be able to ensure accurate tracking of the rear end of the trailer. A return spring 39 biases the arm 18A to the right and further return spring 66 between the valve and the arm 18A biases the linkage 15 into the return position, but will of course be weaker in effect than the spring 33. The spring 39 ensures that the arm 18A moves to the return position should the hydraulic supply to the ram 63 fail.

In the alternative arrangement of Figure 16, the steering linkage 15 is dispensed with and replaced by a master ram 67 pivotally mounted between the arm 29 and part of the vehicle chassis 68 which is interconnected with a slave

ram 69 which operates on the sliding valve 64. Otherwise the mechanism operates in a similar manner to that of Figure 15, except that there is an additional return spring 70 which acts on the arm 29.

If the trailer is to be reversed, then this is best done by retracting both arms 18A (in the examples shown in Figures 6, 7, 15 and 16) and the bogie 6 is steered by means of the servo mechanism 56. In arrangements where no turntable bogie is provided (for example Figures 2 and 14) the arms 18A are fully closed for reversing, as they are for override control by the driver during forward travel.

It will be appreciated that amongst many other modifications which may be made to the design of the apparatus shown in the drawings, the clutch device as illustrated in Figures 3, 4, 5 and 7, for interconnecting the body 22 with the disc 25, may be replaced by other forms of clutch of essentially conventional design, and incorporating releasing members operated upon contact by the adjustable screw 21.

Claims

1. A steering mechanism for a long vehicle having leading and trailing ends and comprising:—

a first steering device located towards the leading end;

a second steering device (6) located towards the trailing end;

a linkage (10—22) between the first and second steering devices;

actuating means within that linkage, and responsive both to a first angle which the first steering device makes with the fore-and-aft centreline of the vehicle and a second angle which the second steering device makes with the same line;

said actuating means being designed to operate on the second steering device to cause the trailing end of the vehicle to follow an existing direction of motion whenever the second angle is less than a predetermined function of the first angle, but operating under other conditions on the second steering device to cause the trailing end of the vehicle to progress to a condition wherein quality between the second angle and that function of the first angle is achieved,

characterised in that a steering member (8) is located towards the trailing end and is controlled by the second steering device (6) so that the steering member (8) will act in a steering mode in which it positively steers that end of the vehicle or in a following mode in which it follows an existing direction of motion which is in a straight line or follows an arc of constant radius; and

the second steering device (6) includes a follower member (25) which is freely rotatable about a vertical axis of the vehicle so as to be free to follow an existing direction of motion and forming part of means to steer the steering member (8), and the actuating means comprises a guide member (22) which is interlocked with the follower member (25) in the following mode for rotational movement therewith and released from the follower member (25) in the steering mode so as to rotate relative to the follower member (25) and cause adjustment of the steering member (8), such that the second steering device (6) locks the steering member (8) in its following mode whenever the second angle is less than the predetermined function of the first angle, but operates under other conditions to make the steering member (8) operate in its steering mode in a manner which tends to make the second steering device (6) progress to the condition wherein equality between the second angle and that function of the first angle is achieved.

2. A steering mechanism according to claim 1, further characterised by two linkages (15) which will be displaced independently as the leading end of the vehicle moves to the right or left respectively.

3. A steering mechanism according to claim 2, further characterised in that the two linkages (15) operate upon respective locking mechanism (21, 23) which control the interconnection of the guide member (22) with the follower member (25) and the extent of allowable movement of the guide member (22).

4. A steering mechanism according to claim 3, further characterised in that the locking mechanism (21, 23) comprises a first part (23) which, upon displacement of one of the linkages (15), locks the guide member (22) against rotation in one direction relative to the follower member (25), and a second part (21) which, when the guide member (22) has been rotated with the follower member (25), to a condition wherein the actuating means is in the steering mode, will release the lock between the guide member (22) and the follower member (25) and also prevent further rotation of the guide member (22) in the one direction.

5. A steering mechanism according to claim 3 or claim 4, further characterised in that the locking mechanism is in the form of a clutch, a calliper brake or stepless ratchet.

6. A steering mechanism according to claim 3 or claim 4, further characterised in that the locking mechanism incorporates a disc-like follower member (25) and gripping members (23, 37) which are biased into locking contact with the disc to prevent rotation of a portion of the guide member (22) in one direction or the other about the axis of the disc.

7. A steering mechanism according to claim 6, further characterised in that the two linkages (15) each incorporate a release member (21) which will act upon the gripping members (23, 37) to release the gripping members from the disc (25), to enable relative rotation between the guide member (22) and the follower member (25) to take place and thus cause operation of the steering member (8).

8. A steering mechanism according to claim 6 or claim 7, further characterised in that the

gripping members comprise arms (23) biased into contact with the surface of the disc (25) or balls (37) biased into contact with the disc (25) by inclined planes (36).

9. A steering mechanism according to any one of claims 2 to 8, further characterised in that the linkages (15) are operated upon rotation of a member (10) associated with a rotatable part (3) of the first steering device (1).

10. A steering mechanism according to claim 9, further characterised in that the rotatable part (3) carries cams (10) which operate on slidably mounted blocks (12) to which the linkages (15) are pivotally connected so that these linkages (15) are displaced as the blocks (12) slide in their tracks.

11. A steering mechanism according to claim 9, further characterised in that the rotatable part (3) of the steering mechanism carries arms (29) to which the steering linkages (15) are pivotally connected, these arms (29) being driven round with the rotatable part (3).

12. A steering mechanism according to any one of claims 9 to 11, further characterised by means (34, 35) for limiting the extent of movement of the linkages (15).

13. A steering mechanism according to claim 12, further characterised in that the limiting means includes a spring connection (33, 70) to the rotatable part (3) or the arms (29) carrying the linkages (15), and a limit stop.

14. A steering mechanism according to any one of claims 2 to 13, further characterised in that each linkage (15) controls the position of a valve (64) which in turn controls the operation of a ram (63) whose position determines engagement or disengagement with the second steering device (6).

15. A steering mechanism according to claim 14, further characterised in that each linkage is connected to a respective valve (64) by a master and slave ram arrangement (67, 69).

16. A steering mechanism according to any one of claims 1 to 15, further characterised in that the second steering device comprises a turntable bogie (6) mounted on wheels (8) providing the steering member, a pair of wheels (8) carried by a pivoted axle or a castor-type wheel.

17. A steering mechanism according to claim 16, further characterised in that the turntable bogie (6) or a castor-type wheel is separate from the steering member in the form of wheels (8) carried by one or more steered or pivoted axles.

18. A steering mechanism according to any one of claims 1 to 16, further characterised in that the steering member (8) is controlled by the follower member (25) and comprises wheels carried by steered axles or pivoted axles or a power steering member which acts to steer the follower member relative to the vehicle body.

19. A steering mechanism according to any one of claims 1 to 16, further characterised in that the steering member acts on a differential drive using fixed wheels or left and right tracks.

20. A steering mechanism according to any one of claims 1 to 15, further characterised in that the follower member is in the form of a rubber or vane.

21. A steering mechanism according to claim 20, further characterised in that the steering member is a further rudder which is large enough to be able to create steerage of the rear of the vehicle.

22. A steering mechanism according to any one of claims 1 to 21, further characterised in that the first steering device comprises a steering wheel or tiller, one or more steering axles, a turntable bogie with non-steered axles turned by a drawbar, a turntable bogie which steers itself using one or more steering axles, a pivoted axle or an axle turned by a drawbar, the pivotal interconnection of a driving cab with a trailer, differential drive of left and right non-steered wheels or tracks or, in the case of a ship or boat, a rudder, or some other rotatable part, which initiates steering of the leading end of the vehicle.

Patentansprüche

1. Lenkmechanismus für ein Langfahrzeug mit einem vorderen und einem hinteren Ende, einer ersten Lenkeinrichtung an vorderen Ende, einer zweiten Lenkeinrichtung (6) am hinteren Ende, einer Verbindung (10—22) zwischen der ersten und der zweiten Lenkeinrichtung, Betätigungsmitteln in der Verbindung, die sowohl auf einen ersten Winkel, den die erste Lenkeinrichtung mit der Längsmittelachse des Fährzeuges einschließt, als auch auf einen zweiten Winkel, den die zweite Lenkeinrichtung mit dieser Achse einschließt, anspricht, wobei die Betätigungsmittel so ausgebildet sind, daß sie auf die zweite Lenkeinrichtung so einwirken, daß das hintere Ende des Fahrzeuges einer bestehenden Bewegungsrichtung folgt, wenn der zweite Winkel kleiner ist als eine vorbestimmte Funktion des ersten Winkels, jedoch unter anderen Bedingungen eine Vorwärtsbewegung des hinteren Endes in eine Lage bewirkt, in der Gleichheit zwischen dem zweiten Winkel und der genannten Funktion des ersten Winkels erreicht wird, dadurch gekennzeichnet, daß zum hinteren Ende hin ein Lenkglied (8) angeordnet ist, das von der zweiten Lenkeinrichtung (6) so gesteuert ist, daß es in einem Lenkmodus wirkt, in welchem es dieses Ende des Fahrzeuges zwangsläufig steuert, oder in einem Folgemodus, in welchem es einer betehenden Bewegungsrichtung, die in einer Geraden liegt, oder einem Bogen mit konstantem Radius folgt, und daß die zweite Lenkeinrichtung (6) ein Bauteil (25) aufweist, das um eine senkrechte Achse des Fahrzeuges frei drehbar ist und dadurch frei einer bestehenden Bewegungsrichtung folgen kann, und das einen Teil von Mitteln zum Lenken des Lenkgliedes (8) bildet, und Betätigungsmittel ein Führungsglied (22) aufweisen, das in dem Folgemodus mit dem Bauteil (25) zur gemeinsamen Drehung gekoppelt und in dem Lenkmodus von diesem gelöst ist und relativ zu diesem frei drehbar ist und eine Verstellung des Lenkgliedes (8) bewirkt, derart, daß die zweite Lenkeinrichtung

(6) des Lenkglied (8) in seinem Folgemodus sperrt, wenn der zweite Winkel kleiner ist als die vorbestimmte Funktion des ersten Winkels, jedoch unter anderen Bedingungen das Lenkglied (8) in seinem Lenkmodus in einer Weise arbeiten läßt, die bestreht ist, die zweite Lenkeinrichtung (6) in eine Lage zu bringen, in der Gleichheit zwischen dem zweiten Winkel und der genannten Funktion des ersten Winkels erreicht ist.

2. Lenkmechanismus nach Anspruch 1, gekennzeichnet durch zwei Lenkgestänge (15), die unabhängig voneinander verstellt werden, wenn das vordere Ende des Fahrzeuges sich nach rechts oder links bewegt.

3. Lenkmechanismus nach Anspruch 1, dadurch gekennzeichnet, daß die beiden Lenkgestänge (15) auf Sperrmittel (21, 23) einwirken, welche die Koppelung des Führungsgliedes (22) mit dem Bauteil (25) und des Ausmaß der zugelassenen Bewegung des Führungsgliedes (22) steuern.

4. Lenkmechanismus nach Anspruch 3, dadurch gekennzeichnet, daß die Sperrmittel (21, 23) ein erstes Teil (23) aufweisen, das bei einer Verstellung eines der Lenkgestänge (15) das Führungsglied (22) gegen Verdrehung in einer Richtung relativ zu dem Bauteil (25) sperrt, sowie ein zweites Teil (21), das nach einer Verdrehung des Rührungsgliedes (22) zusammen mit dem Bauteil (25) in eine Lage, in der die Betätigungsmittel sich im Lenkmodus befinden, die Sperre zwischen dem Führungsglied (22) und dem Bauteil (25) löst und eine weitere Drehung des Führungsgliedes (22) in der einen Richtung verhindert.

5. Lenkmechanismus nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß die Sperrmittel eine Kupplung, eine Sattelbremse oder ein stufenloses Sperrad ist.

6. Lenkmechanismus nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß die Sperrmittel eine Scheibe (25) und Klemmglieder (23, 37) aufweist, die in sperrenden Kontakt mit der Scheibe vorgespannt sind, um eine Drehung eines Teiles des Führungsgliedes (22) in die eine oder die andere Richtung um die Achse der Scheibe zu verhindern.

7. Lenkmechanismus nach Anspruch 6, dadurch gekennzeichnet, daß die beiden Lenkgestänge (15) jeweils ein Auslöseglied (21) aufweisen, das auf die Klemmglieder (23, 37) wirkt, um diese von der Scheibe (25) zu lösen und eine relative Drehung zwischen dem Führungsglied (22) und der Scheibe (25) zuzulassen und damit eine Betätigung des Lenkgliedes (8) zu bewirken.

8. Lenkmechanismus nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß die Klemmglieder Arme (23) aufweisen, die in Anlage an die Oberfläche der Scheibe (25) vorgespannt sind, oder Kugeln (37), die durch Schrägflächen (36) in Kontakt mit der Scheibe (25) gedrückt sind.

9. Lenkmechanismus nach einem der Ansprüche 2 bis 8, dadurch gekennzeichnet, daß die Lenkgestünge (15) bei Drehung eines Teils (10) bewegt werden, das mit einem drehbaren Teil (3) der ersten Lenkeinrichtung (1) vereinigt ist.

10. Lenkmechanismus nach Anspruch 9, dadurch gekennzeichnet, daß das drehbare Teil (3) Nocken (10) trägt, die auf verschiebbar gelagerte Blöcke (12) einwirken, en denen die Lenkgestänge (15) schwenkbar befestigt sind, so daß diese verstellt werden, wenn sich die Blöcke (12) in ihren Führungen verschieben.

11. Lenkmechanismus nach Anspruch 9, dadurch gekennzeichnet, daß das drehbare Teil (3) des Lenkmechanismus Arme (29) trägt, die mit dem drehbaren Teil (3) gedreht werden und an denen die Lenkgestänge (15) schwenkbar angebracht sind.

12. Lenkmechanismus nach einem der Ansprüche 9 bis 11, gekennzeichnet duch Mittel (34, 35) zur Begrenzung der Bewegung der Lenkgestänge (15).

13. Lenkmechanismus nach Anspruch 12, dadurch gekennzeichnet, daß die Begrenzungsmittel eine federnde Verbindung (33, 70) mit dem drehbaren Teil (3) oder den die Lenkgestänge (15) tragenden Armen (29) und einen Begrenzungsanschlag aufweisen.

14. Lenkmechanismus nach einem der Ansprüche 2 bis 13, dadurch gekennzeichnet, daß jedes Lenkgestänge (15) die Stellung eines Ventils (64) steuert, das seinerseits die Arbeitsweise eines Druckkolbens (63) steuert, dessen Stellung Eingriff oder Außereingriff mit der zweiten Lenkeinrichtung (6) bestimmt.

15. Lenkmechanismus nach Anspruch 14, dadurch gekennzeichnet, daß jedes Lenkgestänge (15) mit dem zugehörigen Ventil (64) durch eine Führungs- und Folge-Druckkolbenanordnung (67, 69) verbunden ist.

16. Lenkmechanismus nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß die zweite Lenkeinrichtung einen Drehschemel (6) aufweist, der auf Rädern (8) angeordnet ist, welche das Lenkglied bilden, wobei ein Radpaar von einer drehbaren Achse getragen sind, oder ein Schwenkrad (9).

17. Lenkmechanismus nach Anspruch 16, dadurch gekennzeichnet, daß der Drehschemel (6) oder ein Schwenkrad (9) von dem Lenkglied in Form von Rädern (8) getrennt ist, die von einer oder mehreren gelenkten oder drehbaren Achsen getragen sind.

18. Lenkmechanismus nach einem der Ansprüche 1 bis 16, dadurch gekennzeichnet, daß das Lenkglied (8) von dem Bauteil (25) gesteuert ist und Räder aufweist, die von gelenkten oder drehbaren Achsen oder einer Servolenkeinrichtung getragen sind, welche das Bauteil relativ zu dem Fahrzeugkörper lenkt.

19. Lenkmechanismus nach einem der Ansprüche 1 bis 16, dadurch gekennzeichnet, daß das Lenkglied auf einen Differentialtrieb mit nicht lenkbaren Rädern oder linken und rechten Gleisketten einwirkt.

20. Lenkmechanismus nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß das Bauteil in Form eines Ruders oder Flügels ist.

21. Lenkmechanismus nach Anspruch 20, dadurch gekennzeichnet, daß das Lenkglied in Form

eines weiteren Ruders ist, das groß genug ist, um ein Lenken des hinteren Endes des Fahrzeuges zu bewirken.

22. Lenkmechanismus nach einem der Ansprüche 1 bis 21, dadurch gekennzeichnet, daß die erste Lenkeinrichtung ein Lenkrad oder einen Handgriff, eine oder mehrere Lenkachsen, einen Drehschemel mit nichtgelenkten Achsen, der von einer Deichsel gedreht wird, einen selbstlenkenden Drehschemel mit einer oder mehreren Lenkachsen, eine drehbare Achse oder eine durch eine Zugstange drehbare Achse, die schwenkbare Verbindung eines Zugwagens mit einem Anhänger, einen Differentialantrieb von nichtgelenkten linken und rechten Rädern oder Gleisketten, oder im Falle eines Schiffes oder Bootes ein Ruder oder ein anderes drehbares Teil aufweist, welches die Lenkung des vorderen Endes des Fahrzeuges einleitet.

Revendications

1. Mécanisme de direction pour un véhicule ou un autre moyen de transport de grande longueur, présentant une extrémité avant et une extrémité arrière et comprenant:

un premier dispositif de direction placé près de l'extrémité avant;

un second dispositif de direction (6) placé près de l'extrémité arrière;

une timonerie (10—22) entre le premier et le second dispositif de direction;

un moyen d'actionnement situé dans cette timonerie et sensible à la fois à un premier angle que le premier dispositif de direction fait avec l'axe longitudinal du véhicule et à un second angle que le second dispositif de direction fait avec ce même axe;

le moyen d'actionnement étant conçu pour agir sur le second dispositif de direction pour amener l'extrémité arrière du véhicule à suivre une direction de mouvement existante chaque fois que le second angle est inférieur à une fonction prédéterminée du premier angle, mais agissant sous d'autres conditions sur le second dispositif de direction pour amener l'extrémité arrière du véhicule à s'approcher d'un état où il y a égalité entre le second angle et cette fonction au premier angle,

caractérisé en ce qu'un organe directeur (8) est placé près de l'extrémité arrière et est commandé par le second dispositif de direction (6), de manière que l'organe directeur (8) agisse suivant un mode direction dans lequel cet organe dirige par force cette extrémité du véhicule, ou agisse suivant un mode poursuite dans lequel l'organe directeur suit une direction de mouvement existante, qui est une ligne droite ou qui suit un arc de rayon constant; et

le second dispositif de direction (6) comporte un élément suiveur (25) qui est librement rotatif autour d'un axe vertical du véhicule, de manière qu'il soit libre de suivre une direction de mouvement existante, et qui fait partie d'un moyen pour orienter l'organe directeur (8), et le moyen d'actionnement comprend un guide (22) qui est verrouillé avec l'élément suiveur (25) dans le mode poursuite, où il tourne conjointement avec celui-ci, le guide étant libéré par rapport à l'élément suiveur (25) dans le mode direction, de sorte qu'il peut tourner par rapport à cet élément suiveur (25) et produire l'ajustement de l'organe directeur (8), l'agencement étant tel que le second dispositif de direction (6) bloque l'organe directeur (8) dans son mode poursuite chaque fois que le second angle est inférieur à la fonction prédéterminée du premier angle, mais agit sous d'autres conditions pour faire agir l'organe directeur (8) dans son mode direction d'une manière tendant à rapprocher le second dispositif de direction (6) de l'état où il y a égalité entre le second angle et ladite fonction du premier angle.

2. Mécanisme de direction selon la revendication 1, caractérisé par deux barres d'accouplement longitudinales (15) ou d'autres moyens d'accouplement qui sont déplacés indépendamment l'un de l'autre lorsque l'extrémité avant du véhicule tourne vers la droite ou tourne vers la gauche.

3. Mécanisme de direction selon la revendication 2, caractérisé en ce que les deux barres d'accouplement (15) agissent sur des mécanismes de blocage respectifs (21, 23) qui commandent le verrouillage entre le guide (22) et l'élément suiveur (25) et limitent l'amplitude du mouvement permis au guide (22).

4. Mécanisme de direction selon la revendication 3, caractérisé en ce que le mécanisme de blocage (21, 23) comprend une première pièce (23) qui, au déplacement d'une des barres d'accouplement (15), bloque la rotation du guide (22) dans un sens, par rapport à l'élément suiveur (25), et une deuxième pièce (21) qui, lorsque le guide (22) a été tourné avec l'élément suiveur (25), jusqu'à l'obtention d'un état où le moyen d'actionnement est dans le mode direction, supprime le verrouillage entre le guide (22) et l'élément suiveur (25) et empêche également la poursuite de la rotation du guide (22) dans ladite direction.

5. Mécanisme de direction selon la revendication 3 ou 4, caractérisé en ce que le mécanisme de blocage est constitué par un accouplement débrayable, un frein à disque ou un mécanisme d'arrêt sans gradation.

6. Mécanisme de direction selon la revendication 3 ou 4, caractérisé en ce que le mécanisme de blocage comporte un élément suiveur (25) en forme de disque et des éléments de serrage (23, 37) qui sont chargés élastiquement pour venir en contact de blocage avec le disque pour empêcher la rotation d'une partie du guide (22) dans un sens ou dans l'autre autour de l'axe du disque.

7. Mécanisme de direction selon la revendication 6, caractérisé en ce que les deux barres d'accouplement (15) comportent chacune un élément de libération (21) destiné à agir sur les éléments de serrage (23, 37) pour les écarter du disque (25), afin de permettre une rotation relative entre le guide (22) et l'élément suiveur (25) et

de provoquer ainsi la manoeuvre de l'organe directeur (8).

8. Mécanisme de direction selon la revendication 6 ou 7, caractérisé en ce que les éléments de serrage sont constitués par des bras (23) chargés élastiquement pour venir en contact avec la surface du disque (25), ou par des billes (37) chargées élastiquement pour venir en contact avec le disque (25) par des rampes (36).

9. Mécanisme de direction selon l'une quelconque des revendications 2 à 8, caractérisé en ce que les barres d'accouplement (15) sont manoeuvrées sous l'effet de la rotation d'un élément (10) coordonné à une pièce rotative (3) du premier dispositif de direction (1).

10. Mécanisme de direction selon la revendication 9, caractérisé en ce que la pièce rotative (3) porte des cames (10) qui agissent sur des coulisseaux (12), auxquels sont articulées les barres d'accouplement (15), de sorte que ces barres sont déplacées lorsque les coulisseaux (12) se déplacent dans leurs glissières.

11. Mécanisme de direction selon la revendication 9, caractérisé en ce que la pièce rotative (3) du premier dispositif de direction porte des bras (29), auxquels sont articulées les barres d'accouplement (15) et qui sont entraînés en rotation conjointement avec la pièce rotative (3).

12. Mécanisme de direction selon l'une quelconque des revendications 9 à 11, caractérisé par un moyen (34, 35) pour limiter l'amplitude du mouvement des barres d'accouplement (15).

13. Mécanisme de direction selon la revendication 12, caractérisé en ce que le moyen de limitation comporte une liaison élastique (33, 70) avec la pièce rotative (3), ou avec les bras (29) portant les barres d'accouplement (15), de même qu'une butée.

14. Mécanisme de direction selon l'une quelconque des revendications 2 à 13, caractérisé en ce que chaque barre d'accouplement (15) commande la position d'un distributeur (64) commandant lui-même la manoeuvre d'un vérin (63) dont la position détermine l'action sur le second dispositif de direction (6) ou l'écartement par rapport à celui-ci.

15. Mécanisme de direction selon la revendication 14, caractérisé en ce que chaque barre ou autre moyen d'accouplement est relié à un distributeur (64) correspondant par un montage (67, 69) à maître-cylindre émetteur et vérin récepteur.

16. Mécanisme de direction selon l'une quelconque des revendications 1 à 15, caractérisé en ce que le second dispositif de direction est constitué par un bogie à plateau tournant (6) monté sur des roues (8) constituent l'organe directeur, par une paire de roues (8) montées sur un essieu pivotant ou par une roue orientable.

17. Mécanisme de direction selon la revendication 16, caractérisé en ce que le bogie à plateau tournant (6) ou une roue orientable est prévu séparément d'un organe directeur constitué par des roues (8) montées sur un ou plusieurs essieux directeurs ou pivotants.

18. Mécanisme de direction selon l'une quelconque des revendications 1 à 16, caractérisé en ce que l'organe directeur (8) est commandé par l'élément suiveur (25) et est constitué par des roues montées sur des essieux directeurs ou pivotants, ou par un organe de servodirection qui oriente l'élément suiveur par rapport à la caisse ou au corps du véhicule.

19. Mécanisme de direction selon l'une quelconque des revendications 1 à 16, caractérisé en ce que l'organe directeur agit sur une commande différentielle utilisant des roues non orientables ou des chenilles gauche et droite.

20. Mécanisme de direction selon l'une quelconque des revendications 1 à 15 et s'appliquant en particulier à un moyen de transport non terrestre, caractérisé en ce que l'élément suiveur a la forme d'un gouvernail ou d'une aube.

21. Mécanisme de direction selon la revendication 20, caractérisé en ce que l'organe directeur est un gouvernail supplémentaire qui est suffisamment grand pour pouvoir diriger le moyen de transport à l'arrière de celui-ci.

22. Mécanisme de direction selon l'une quelconque des revendications 1 à 21, caractérisé en ce que le premier dispositif de direction est constitué par un volant de direction ou un timon de commande, par un ou plusieurs essieux directeurs, par un bogie à plateau tournant, combiné avec des essieux non dirigés qui sont tournés au moyen d'une barre d'attelage, par un bogie à plateau tournant qui s'oriente lui-même en utilisant un ou plusieurs essieux directeurs, un essieu pivotant ou un essieu tourné au moyen d'une barre d'attelage, par la liaison articulée entre un tracteur routier et une semiremorque, une commande différentielle de roues ou de chenilles non orientables situées à gauche et à droite ou, dans le cas d'un navire ou d'un bâteau, par un gouvernail ou un autre organe rotatif capable de produire le changement de direction de l'extrémité avant du moyen de transport.

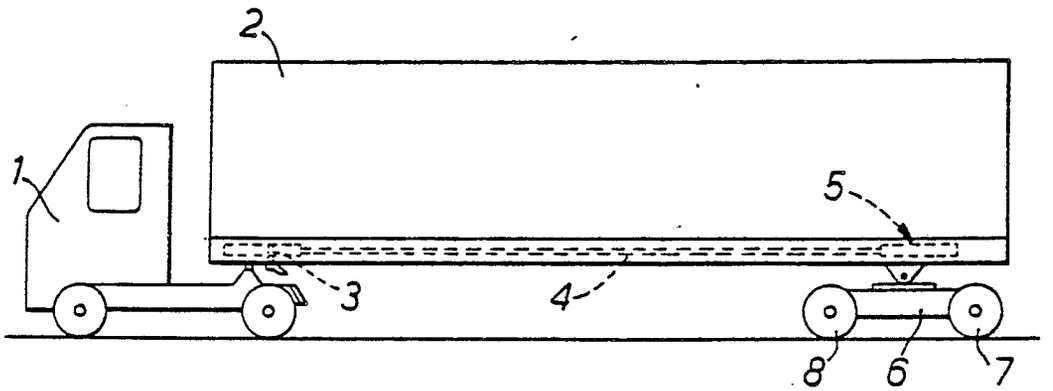


FIG. 1.

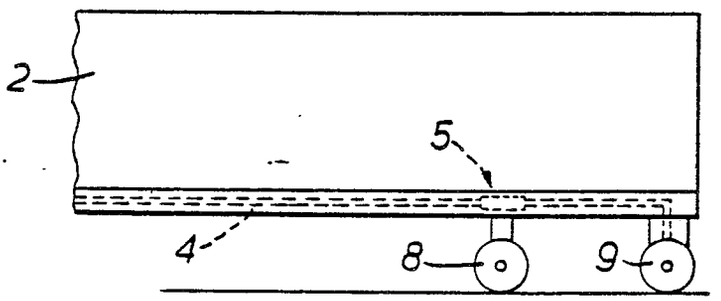


FIG. 2.

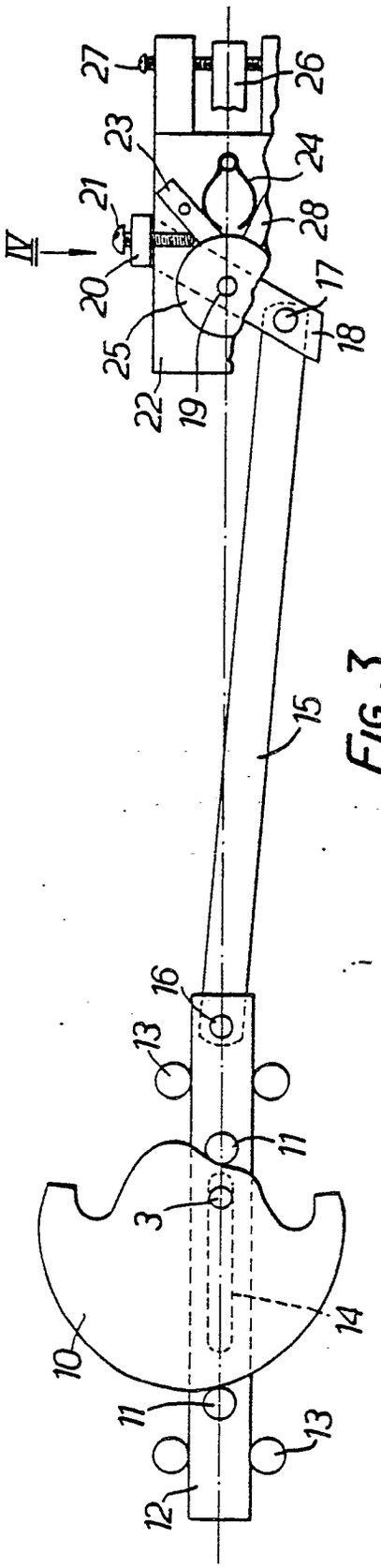


FIG. 3.

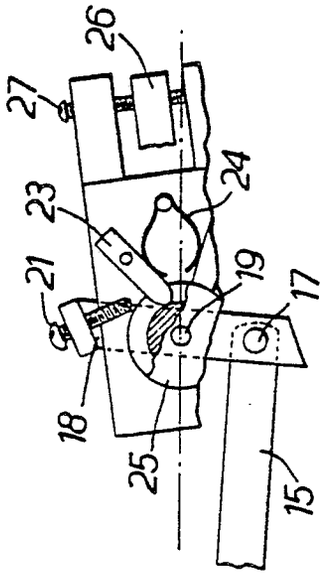


FIG. 5.

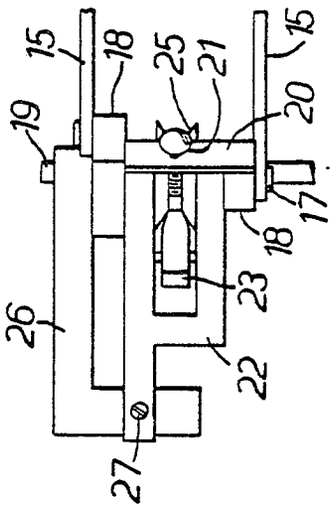


FIG. 4.

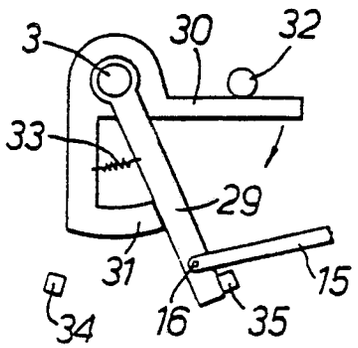


FIG.6.

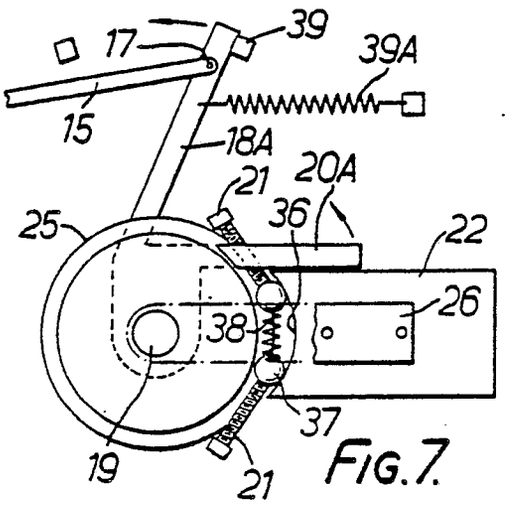


FIG.7.

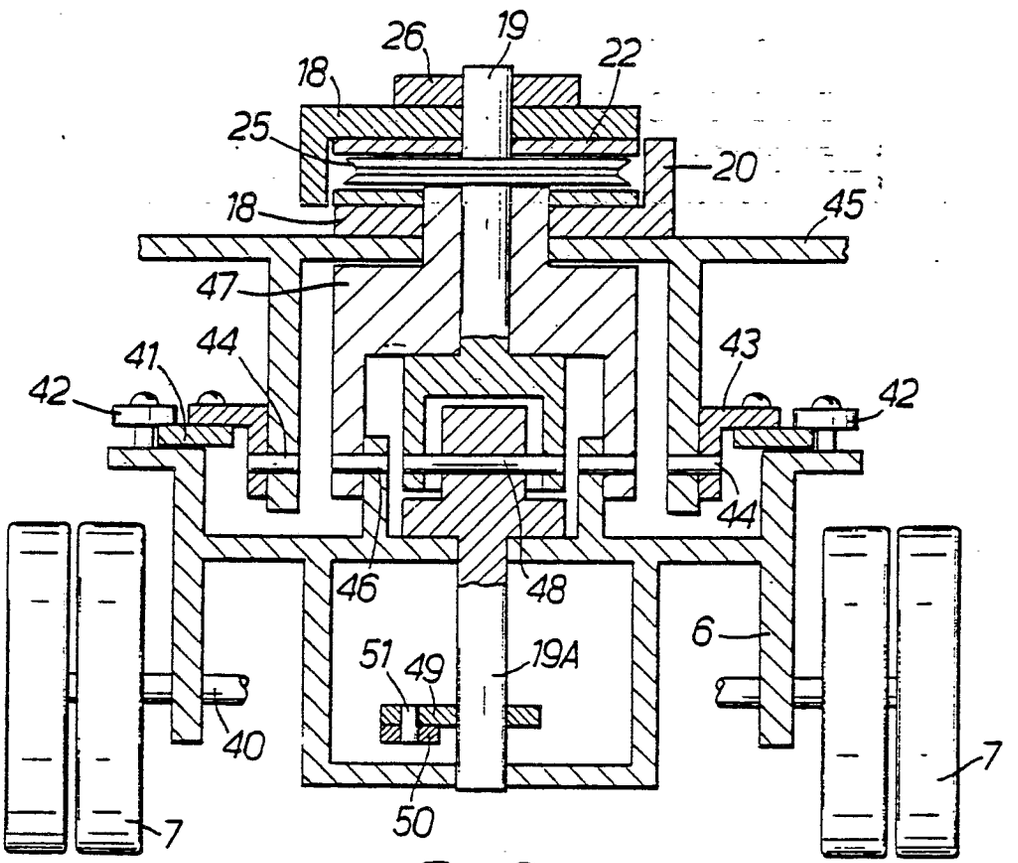


FIG.8.

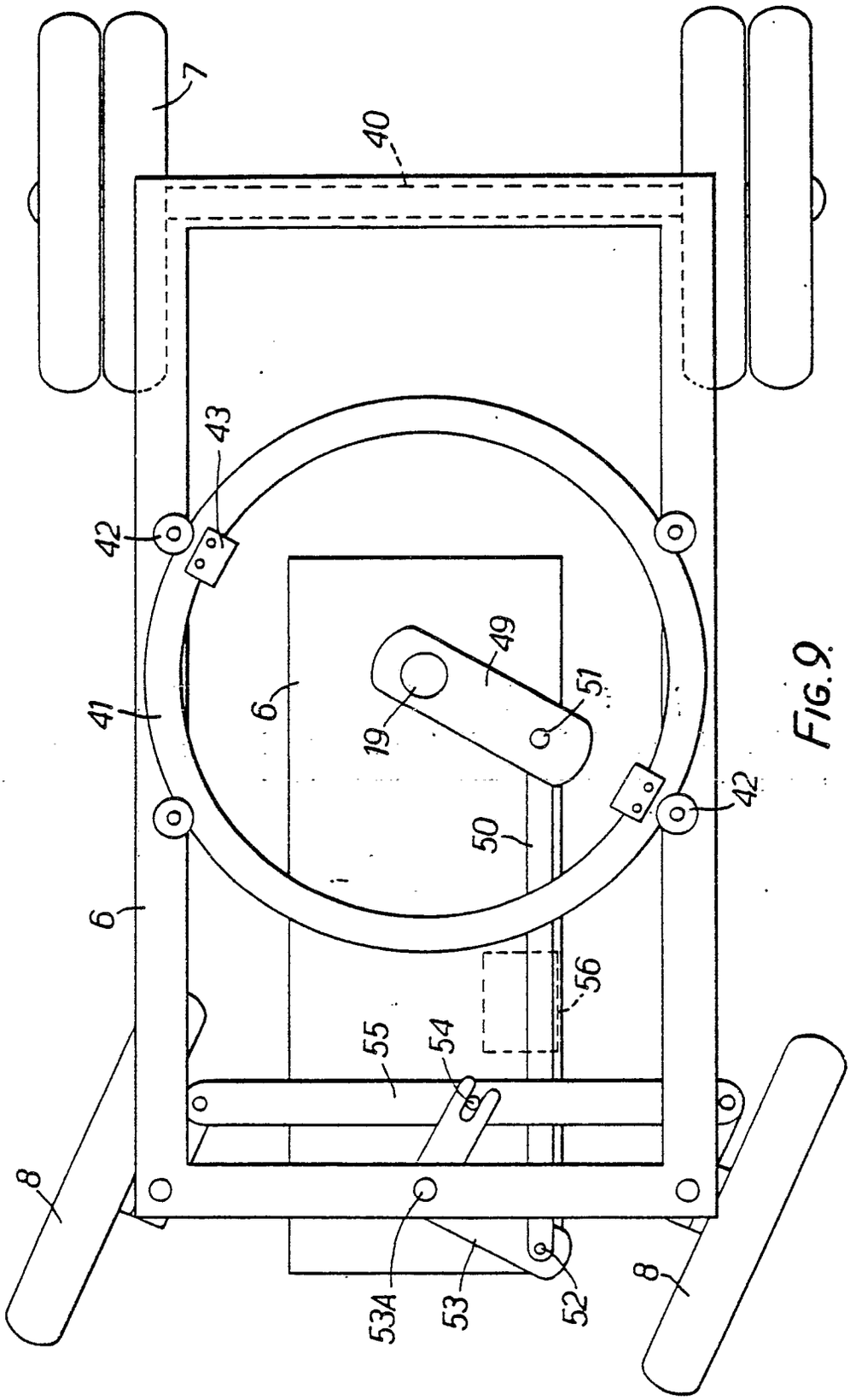


FIG. 9

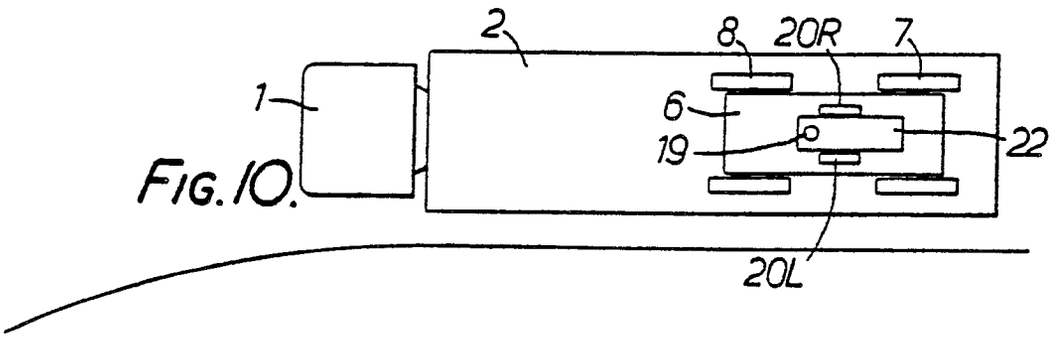


FIG. 10.

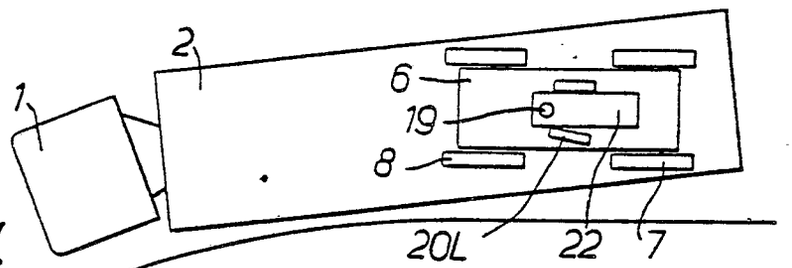


FIG. 11.

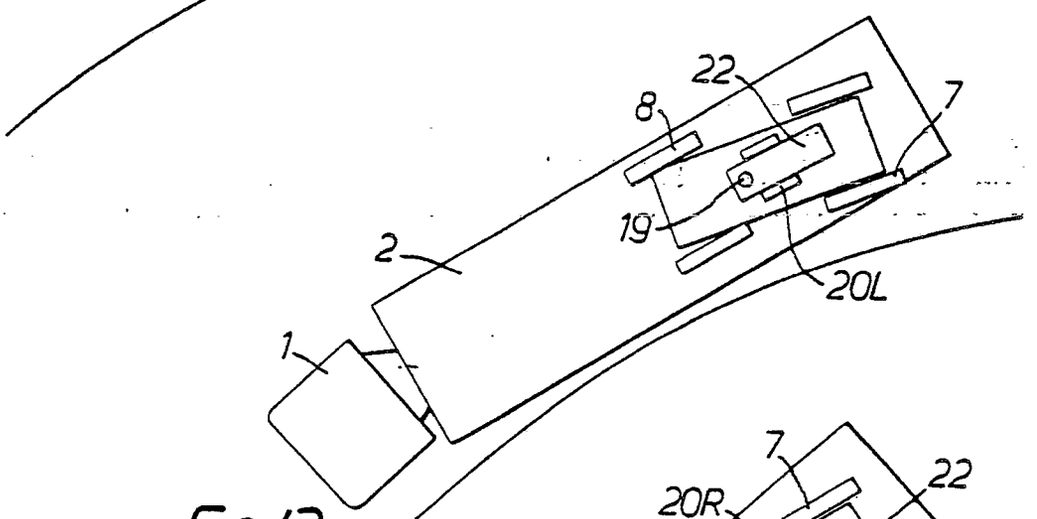


FIG. 12.

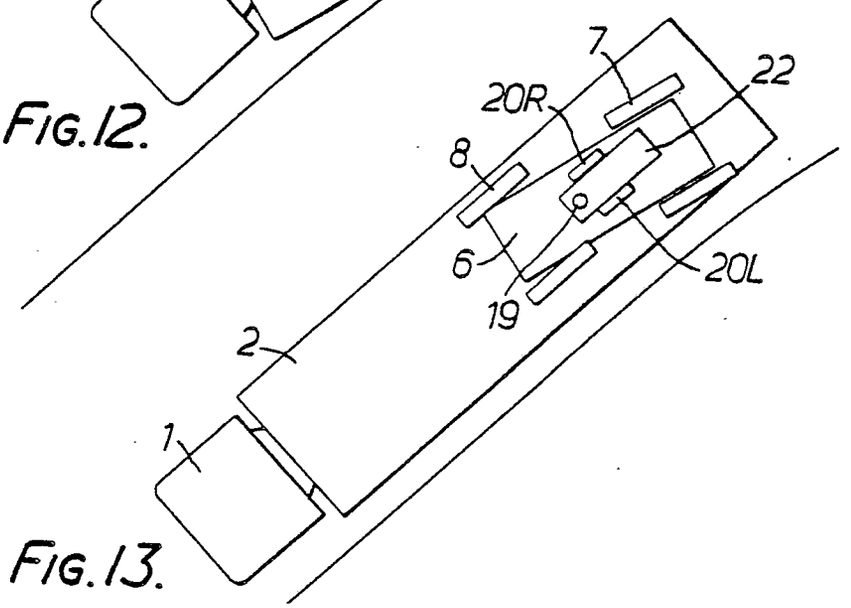


FIG. 13.

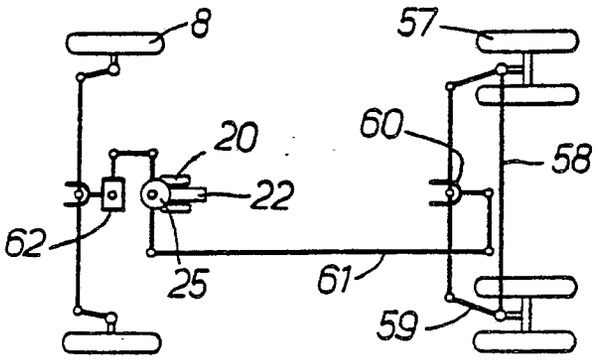


FIG.14.

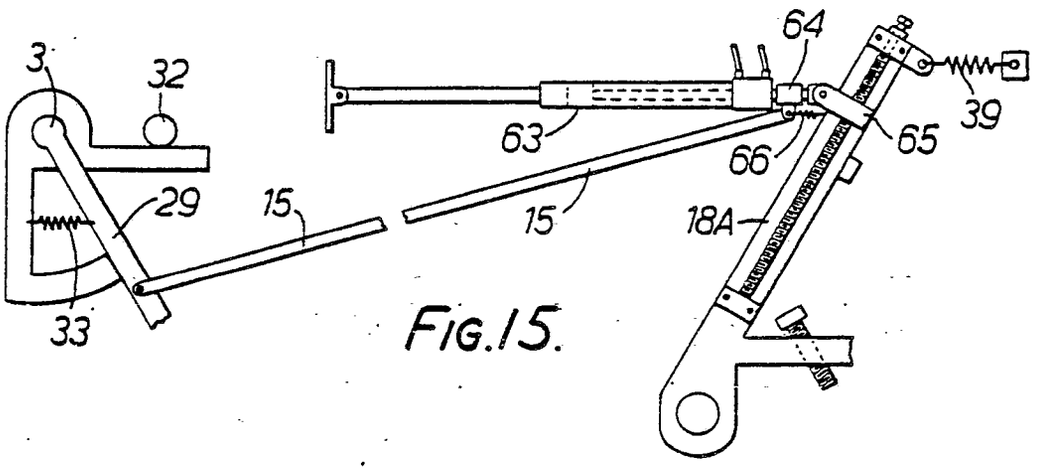


FIG.15.

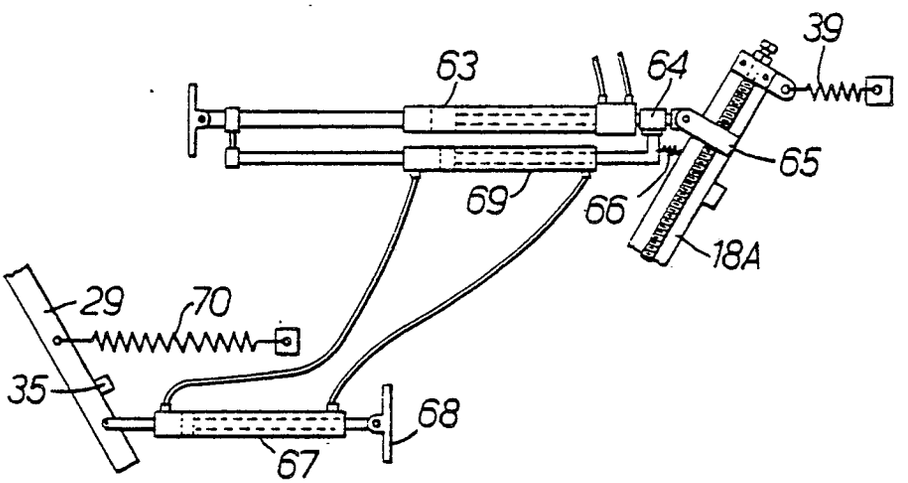


FIG.16.